
Stroke Prevalence: an Analysis of Data From the 1977 National Health Interview Survey

HERBERT M. BAUM, PhD

STROKE (CEREBROVASCULAR DISEASE) has ranked as the third leading cause of death in the United States for more than a decade. According to the National Center for Health Statistics (NCHS), in 1978 an estimated 172,520 deaths were attributable to stroke—accounting for 9 percent of all deaths in this country (1). NCHS also estimated that during the preceding 10 years, 1968–78, the age-adjusted death rate for stroke decreased by 37.7 percent. This dramatic decline may have been the result of either a decrease in the incidence of stroke or an increase in survivorship, or both. The possibility of increased survivorship has directed the administrators of the National Institute of Neurological and Communicative Disorders and Stroke (NINCDS) toward a greater interest in stroke prevalence. As a consequence, the Office of Biometry and Field Studies of NINCDS used the National Health Interview Survey (NHIS) of NCHS as a mechanism for estimating stroke prevalence.

This paper is based on data gathered as part of the 1977 NHIS, which is an annual nationwide household survey. During each week of the year a sample of households is drawn, and interviews are conducted to obtain information about health and other characteristics of each household member. The U.S. Bureau of the Census conducts the interviews. With proper weighting, the results are representative of the U.S. civilian noninstitutionalized population (2). In 1975, NINCDS explored the feasibility of adding questions concerning stroke history, symp-

tomatology, diagnosis, hospitalization, and current medical conditions to the standard questionnaire to be administered in the 1977 round of the NHIS. The estimates derived from the survey were analyzed and classified by the following demographic variables: current age, age at first stroke, race, and sex.

The methodology used to obtain the data imposes certain restrictions on interpretation of the results. The NHIS relies solely on informants' ability to recall, identify, and report the condition, its time of occurrence, and its duration. There is no diagnostic verification of informants' reports. Prevalence and other estimates may be slightly undercounted because data pertaining to those who died during the reporting period are missing. This omission occurs because the data are gathered on a rotating, rather than a one-time, basis. Although the extent of underestimation for the prevalence estimate is not quantifiable, it is thought to be greatest among the elderly.

Results

It was estimated that in 1977 approximately 2.7 million people aged 20 and over had suffered a stroke (hereafter termed the ever-had group), based on responses to the following series of questions.

Has _____ EVER had a stroke?
Has a doctor EVER told _____ he had a stroke?
How old was _____ at the time of his first stroke?
Was _____ hospitalized for his first stroke?

Based on a population at risk of 137.2 million, the total prevalence rate for 1977 was 1,968 per 100,000. This rate differed by age and race-sex categories. An estimated 84.3 percent of the total number of stroke victims had been informed by a doctor that a stroke had occurred. This group (hereafter termed the medically-informed stroke group) was slightly older and had a slightly higher percentage of whites and men than the uninformed group (table 1). Except for age,

Tearsheet requests to Dr. Herbert M. Baum, Demographer, Office of Biometry and Field Studies, National Institute of Neurological and Communicative Disorders and Stroke, National Institutes of Health, Federal Bldg., Room 7C14, 7750 Wisconsin Ave., Bethesda, Md. 20205.

Ms. Abigail Moss, Division of Health Interview Statistics, National Center for Health Statistics, assisted with the generation of the tabulations presented in this paper.

the differences were not large enough to warrant treating the medically-informed and the uninformed groups as separate entities. Although there may be less misreporting among the medically-informed stroke group, the focus of this analysis is on the ever-had group. It was not expected that all strokes would be confirmed by a physician, especially transient ischemic attacks (TIAs) (3). Also, patients in some areas of the country have only limited access to physicians.

The number of stroke cases and the prevalence rate per 100,000 population increased markedly with age, corroborating what had been found previously (4). The prevalence rate for ages 20–44 was approximately 390 per 100,000, but it was about 7,000 for the 65 and over age group. The actual difference in rates may be even greater than the eighteenfold difference noted because of the possibly greater underenumeration among the elderly. The age differ-

ential persisted within each race-sex category examined. Consequently, all further analyses were based on age-specific or age-standardized data.

The prevalence rates for the four race-sex categories are shown in figure 1. The age-specific prevalence rates for black women were greater than 1½ times the corresponding rates for white women. This difference in rates peaked at the 20–44 age group, where the difference was greater than twofold (802 versus 375). The crude prevalence rate for black men was greater than that for white men (2,319 versus 2,023); age adjustment amplified this difference (2,654 versus 2,140). Differences between the rates for men resulted primarily from the higher rates among blacks under age 65—their rates were approximately 1.7 times those of their white counterparts.

Examination of the data categorized by sex revealed that both the crude rates (2,039 versus 1,895) and the adjusted rates (2,174 versus 1,798) were

Table 1. Comparison of reported medically-informed with not medically-informed stroke-affected population, by age, race, and sex, National Health Interview Survey, 1977

Age, race, and sex	Total		Medically informed		Not medically informed	
	Number	Percent ¹	Number	Percent ¹	Number	Percent ¹
Age group (years):						
20–44	287,165	10.7	181,097	8.0	106,068	25.0
45–64	880,662	32.7	738,021	32.5	142,641	33.6
65 and over	1,524,318	56.6	1,349,061	59.4	175,257	41.3
Race:						
White	2,314,382	86.0	1,963,891	86.6	350,491	82.7
Nonwhite	377,763	14.0	304,288	13.4	73,475	17.3
Sex:						
Men	1,315,884	48.9	1,117,417	49.3	198,467	46.8
Women	1,376,261	51.1	1,150,762	50.7	224,499	53.2
Total	2,692,145		2,268,179		423,966	

¹ The percentage is of the total in that group.

Figure 1. Age-specific stroke prevalence rates, by race-sex groups (rates per 100,000)

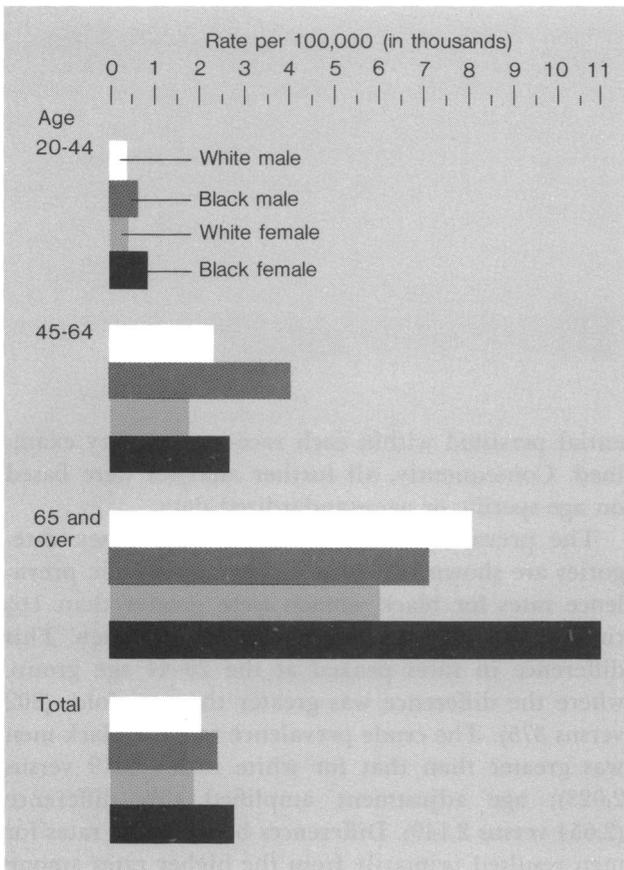


Figure 2. Percentage reporting ever having had a stroke, by age and limitation status

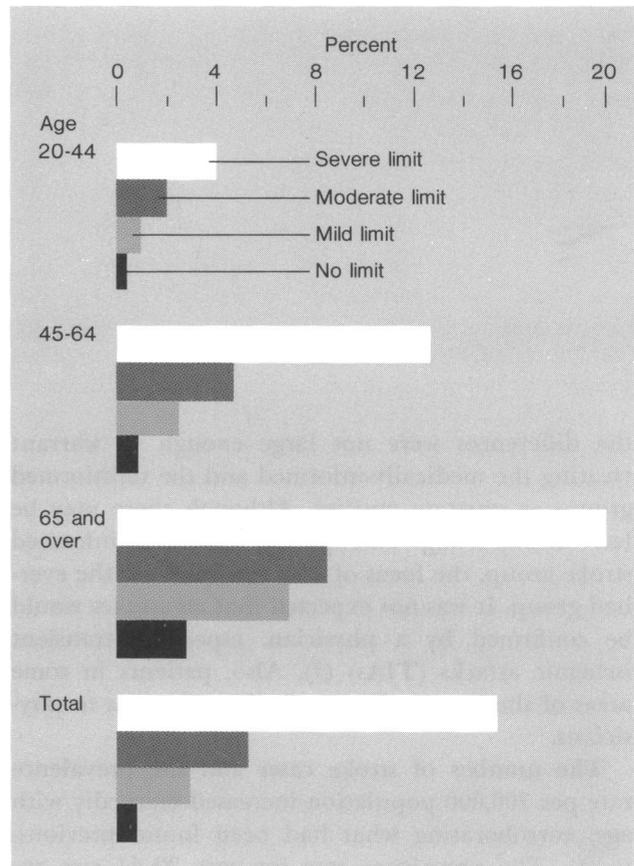


Table 2. Age and race-sex specific stroke prevalence rates by limitation status (rate per 1,000), National Health Interview Survey, 1977

Race-sex and age group (years)	Limitation status			
	Severe 1	Moderate 2	Mild 3	None 4
White men:				
20-44	41.66	7.10	(¹)	2.38
45-64	120.61	44.92	17.82	7.21
65 and over	181.38	71.72	91.43	26.90
Black men:				
20-44	(¹)	20.09	34.32	4.45
45-64	146.08	65.67	39.97	8.48
65 and over	139.97	19.95	(¹)	12.79
White women:				
20-44	18.44	24.56	15.93	2.27
45-64	143.69	44.84	30.67	8.14
65 and over	251.46	86.29	60.74	25.73
Black women:				
20-44	158.83	39.02	(¹)	3.78
45-64	114.79	59.75	31.97	11.43
65 and over	306.44	128.27	112.19	39.05

¹ Insufficient data.

greater for men. Men had higher age-specific rates than women among all age groups except 20-44. However, the higher age-specific rates among men was not observed among blacks. For blacks, both the crude (2,391 versus 2,734) and the adjusted rates (2,654 versus 2,982) were higher for women.

The NHIS protocol requires collection of information on limitation of activity, and it defines four limitation states as follows:

1. Persons unable to carry on major activity for their group (severe limitation)
2. Persons limited in amount or kind of major activity performed (moderate limitation)
3. Persons not limited in major activity but otherwise limited (mild limitation)
4. Persons not limited in activity (no limitation)

The association of high prevalence rates for stroke with severity of the limitation is apparent in figure 2. These data are presented in greater detail in table 2. Within a given age and race-sex category, the stroke prevalence rates decreased from the group with severe limitation to that with no limitation, with three exceptions. Black men aged 20-44 who reported mild

Table 3. Distribution of stroke prevalence by race-sex group and age at first stroke, National Health Interview Survey, 1977

Race-sex group	Total	Age group (years)							
		Under 25		25-44		45-65		65 and over	
		Number	Percent	Number	Percent	Number	Percent	Number	Percent
White men	1,054,617	39,309	3.7	125,893	11.9	504,785	47.9	384,630	36.5
Black men	129,225	6,405	5.0	22,582	17.5	66,528	51.5	33,710	26.1
White women	1,027,017	54,663	5.3	169,725	16.5	357,973	34.9	444,656	43.3
Black women	194,666	19,504	10.0	35,989	18.5	61,975	31.8	77,198	39.7
Total	2,411,799	119,881	5.0	355,812	14.8	991,261	41.1	944,845	39.2

limitation had a higher rate than those with moderate limitation. The same relationship was seen for white men aged 65 and over. White women aged 20-44 had a higher rate for moderate limitation than for severe limitation. In general, for a given limitation state, the prevalence rate showed a monotonic increase with age. Exceptions to this increase occurred among blacks. There was a decrease in the rate as age increased among severely and moderately limited black men, whereas there was a decrease in the rate for severely limited black women between the ages of 20-44 and 45-64.

Data on age at first stroke are presented in figure 3 and table 3. Blacks tended to have their initial strokes at younger ages than whites. Overall, the modal category for age at first stroke was 45-64, but it differed between the sexes. Regardless of race, a larger percentage of women experienced their first stroke at ages 65 and over. One reason for the difference between the sexes may be that, because women live longer than men, more women are at risk in the oldest age group. In 1977, there were 9.6 million men were age 65 and over, representing 9 percent of the total male population, compared with 13.9 million women, representing 13 percent of the total female population (5). In addition, the 65 and over age group has the highest incidence rates for stroke (6).

Overall, 62.4 percent of the stroke victims had been hospitalized for their first stroke (table 4). This percentage differed slightly by age; the highest percentage (66.1) was among those aged 45-64. As expected, for each age group the percentage for whom hospitalization had been reported was higher if the victim had been informed by a physician of the diagnosis than if he or she had not been informed. About one-third of those not informed were hospitalized for their initial stroke. This discrepancy, coupled with the possibility of recall errors, indicates that an adjustment to the percentage of medically informed may be needed.

The hospitalization rates for first stroke differed by race and sex. Within each age category, women (controlling for race) had lower hospitalization rates than men (table 5). Although the overall data indicate a decrease in the percentage hospitalized for first stroke among the 65 and over age group, compared with the younger age groups, this was true only for white men. Overall, the percentage hospitalized was slightly higher for blacks (64.2) than for whites (62.1). The difference in hospitalization rates

Figure 3. Percentage reporting ever having had a stroke, by age at first stroke and race-sex group

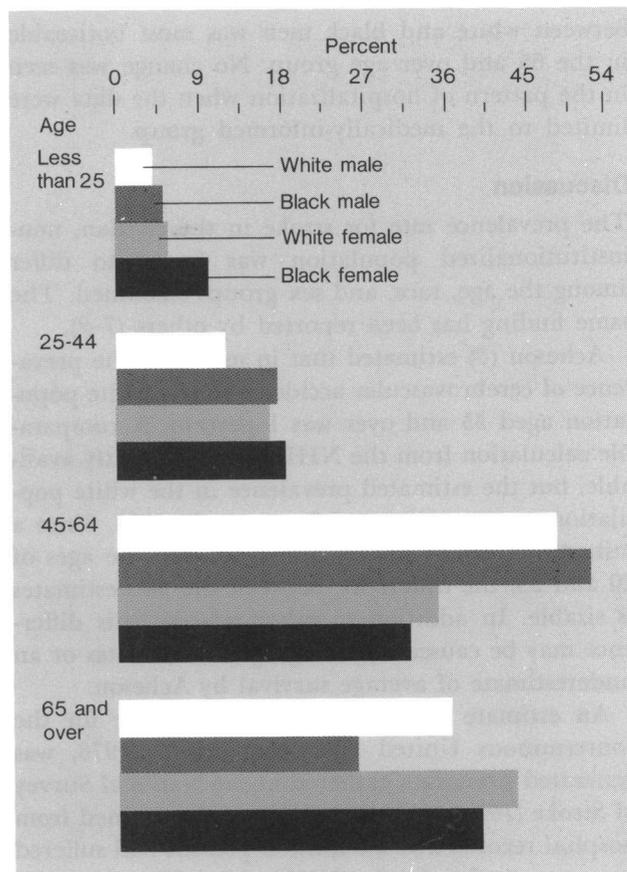


Table 4. Percentage of persons hospitalized for first stroke,¹ National Health Interview Survey, 1977

Age group (years)	Total	Percent reporting hospitalization	Number informed by physician	Percent reporting hospitalization	Number not informed by physician	Percent reporting hospitalization
20-44	207,541	63.40	179,320	67.24	26,593	41.39
45-64	801,206	66.13	724,663	70.77	68,955	16.27
65 and over	1,438,144	60.11	1,322,255	62.33	100,788	37.13
Total ²	2,446,891	62.36	2,226,238	65.41	196,336	30.38

¹ Denominator is all those ever-having had a stroke and reporting a hospitalization status.

² Not additive because of 24,317 persons who did not know whether a physician confirmed their diagnosis.

Table 5. Percentage of persons hospitalized for first stroke, by race-sex and age groups, National Health Interview Survey, 1977

Race-sex group	Age group (years)			Total
	20-44	45-64	65 and over	
White men	74.19	73.07	60.04	65.54
Black men	54.71	73.94	76.15	74.88
White women ...	62.31	56.06	59.31	58.61
Black women ...	50.60	58.09	58.46	56.99
Total	63.40	66.13	60.11	62.36

between white and black men was most noticeable in the 65 and over age group. No change was seen in the pattern of hospitalization when the data were limited to the medically-informed group.

Discussion

The prevalence rate for stroke in the civilian, non-institutionalized population was found to differ among the age, race, and sex groups examined. The same finding has been reported by others (7-9).

Acheson (8) estimated that in mid-1965 the prevalence of cerebrovascular accidents in the white population aged 35 and over was 1 percent. A comparable calculation from the NHIS is not currently available, but the estimated prevalence in the white population over age 20 was 1.9 percent in 1977. Since a minor number of strokes occur between the ages of 20 and 35, the difference between the two estimates is sizable. In addition to other reasons, this difference may be caused by changing survival rates or an underestimate of average survival by Acheson.

An estimate of the prevalence of stroke for the conterminous United States on July 1, 1976, was generated from data gathered in the National Survey of Stroke (10). In this survey, it was determined from hospital records that 1.7 million persons had suffered an acute stroke. In the NHIS, 2.7 million cases of

stroke were reported, and 62.4 percent of these patients had been hospitalized for their first stroke. Therefore, the prevalence of hospitalized stroke patients as reported by the NHIS was 1.68 million, and the NHIS and the National Survey of Stroke are in complete agreement.

Estimates of prevalence for the United States may be calculated from age-specific rates reported in other studies. Based on the Evans County data (7), it was estimated that the prevalence of stroke in the civilian U.S. population aged 45 and over would have been 3.3 million in 1977. Data from Rochester, Minn. (9) yielded a prevalence estimate of 1.3 million, whereas the prevalence estimate from the NHIS was 2.7 million. Because of the small numbers in some cells, Heyman and associates (7) observed a pattern of age-specific prevalence rates in the Evans County study that did not rise consistently with age. Thus, the Evans County study showed 56 percent of the prevalence population in the 65 and over age group, in contrast to 63 percent in the NHIS study and 80 percent in the Rochester study. The projection based on the Rochester data yielded the lowest estimate, partly a result of the extremely low prevalence rate for the age group 45-64 (608 per 100,000). In addition, the age-sex-adjusted prevalence estimate for Rochester has been declining since 1960, which may not be true for the nation as a whole. Due to the limited geographic groups studied, changes in patient management, and differences in physicians' practices, the NHIS estimate, rather than the two other estimates presented, is considered to be a more accurate reflection of the current national prevalence of stroke.

Approximately 80 percent of the stroke victims in the NHIS survey were reported to have had their first stroke after age 45; the percentage was evenly distributed between the age groups 45-64 and 65 and over. For men, the percentage reported to have had their first stroke between the ages of 45-64 was larger

than the percentage who were reported to have had their first stroke at 65 and over. The opposite was true for women, probably because there are more women than men in the older age groups. Blacks tended to have strokes at younger ages than whites. It was not feasible to calculate age-specific rates for the race data because the population at risk could not be determined accurately.

The manner in which the questions were phrased for this survey affected the interpretation of the data on limitation of activity and the physician's telling the patient he or she had a stroke. The data presented here were obtained retrospectively, but not on an event-by-event basis. Since the timing of events was omitted, and because a person can have more than one stroke, it is unclear whether the limitation in activity preceded or succeeded the stroke that was reported or was in fact related to stroke rather than to some other disabling condition. For the group reported as medically informed, it is not known whether the physician informed the victim for each occurrence of stroke or for just one occurrence. Therefore, caution should be exercised in interpreting the results of analyses for these factors and in deriving policy implications from these data.

About 85 percent of all those with a history of stroke were also reported as being medically informed. However, the data on hospitalization for first stroke indicated that this percentage may in fact be higher. Of those reported as being medically uninformed, 30 percent were hospitalized for their first stroke. Thus, these percentages appear to be contradictory. If it is assumed that the patient remembers being hospitalized but does not recall being informed by a physician, the percentage of stroke patients who were medically informed would increase slightly—to 86.4 percent. If the reverse were assumed to be true, then the percentage hospitalized for first stroke would decrease from 62.36 to 59.92. The first assumption seems more plausible. The group reported as being medically informed was slightly older than the uninformed segment. The difference in age distributions could be a result of less underreporting of physicians' confirmation of stroke among the elderly. In the age group 20–44, approximately 63 percent of the persons who reported having had a stroke also reported that they were told so by a physician; however, for the 65 and over age group, 89 percent reported this information. Whether the difference is real or the result of a reporting problem is unknown. Sex and race differences between the medically-informed and the uninformed groups were minimal.

Table 6. Hospitalization rates for incidence of stroke by age, National Health Interview Survey, 1977

Age group ¹	Number of patients	Number hospitalized	Percent hospitalized
20–24	18,162	11,715	64.5
25–34	31,144	13,392	43.0
35–44	73,122	44,790	61.3
45–54	166,771	106,538	63.9
55–64	232,239	178,034	76.7
65–74	366,183	241,744	66.0
75 and over	378,496	225,358	59.5
Total	1,266,117	821,571	64.9

¹ Only for those whose current age group is the same as that for first stroke.

Age, race, and sex were related to the percentage of patients hospitalized for the first stroke; this percentage declined between the age groups 45–64 and 65 and over. The decline may be an artifact caused by three factors: changes in hospitalization practices, omission of those who died in the hospital from the total prevalence numbers, and a high percentage of TIAs among the elderly.

According to data from the Hospital Discharge Survey (11,12), the age-adjusted stroke discharge rate in 1972 was 5.8 per 1,000 population, and the comparable rate for 1977 was 6.6 per 1,000. Therefore, if we assume that the incidence rate of stroke did not change, the data imply that a change in hospitalization practices has been occurring. If the 65 and over age group contains the largest percentage who were reported to have had early strokes, this change would affect them more than the other age groups. The results of an attempt to measure this change are shown in table 6; in this table, only those stroke patients whose current age group is the same as that for their first stroke (termed recent strokes) are shown. Despite this adjustment, the percentage hospitalized still declined at age 65.

Second, the omission from the prevalence tally of patients with more severe cases who died in the hospital affects the elderly more than the other age groups and cannot be quantified. Third, the elderly may have a high percentage of TIAs, and physicians may not hospitalize such patients. However, more information than that collected in the NHIS is needed to substantiate such hypotheses.

It was unexpected that men would have higher hospitalization rates than women and that blacks would have higher hospitalization rates than whites. It is possible that when these groups do see a physician they have more severe cases than others, and therefore a larger percentage require hospitalization.

Alternately, the Hospital Discharge Survey (12) indicates an 18 percent greater hospitalization rate for women than for men (based on all non-maternity discharges); thus, men may have better recall concerning each of their hospitalizations. The Hospital Discharge Survey does not present rates by race because the small cell sizes generate unreliable estimates; however, the same relationship may be true.

A definite relationship was seen between stroke and limitation of activity. The prevalence rates in the more limited activity groups were higher than those in the nonlimited group. For all limitations, the percentage of those who ever had a stroke increased with age for whites but not for blacks. This difference is unexplainable.

Earlier in this paper, the data on the prevalence rate of stroke among those within a given limitation group were examined. It is also possible to study the limitation data another way—that is, to view the percentage of the stroke-affected population with limited activity. Unfortunately, the data do not permit close scrutiny for this question because the standard error for some cells, because of small numbers, is large (more than 60 percent). More than 70 percent of the stroke victims were somewhat limited in their activities, and more than two-thirds were limited in their major activities. This situation differed by age—for the most limited, stroke prevalence varied directly with age, but for the nonlimited, stroke prevalence varied inversely with age. For example, approximately one-half of those with a history of stroke who were aged 65 and over were in the most limited group, whereas 61.1 percent of the 20–44 age group with a history of stroke were in the nonlimited group.

Little difference was seen in the limited and nonlimited activity percentages by race. By sex, however, large differences were observed. Of the men with a history of stroke, 58.1 percent were severely limited and 14.0 percent were moderately limited. The comparable figures for women were 25.1 percent and 35.6 percent. Age adjustment by the indirect method does not noticeably alter these percentages. A possible explanation may lie in the definition of major activity. If the activity of men is more physically demanding than that of women, it may account for the observed differences.

Summary

Data gathered in the 1977 National Health Interview Survey indicate that stroke continues to be a major health problem in the United States. It affects approximately 2 percent of the civilian noninstitu-

tionized population over age 20. An examination of the stroke population revealed differences in the prevalence rates by various demographic factors, particularly age. More than 70 percent of the stroke victims were limited in their activities, and about 85 percent of all the victims had been informed of their condition by a physician. Only 62 percent indicated that they were hospitalized for their first stroke, and this finding remained unchanged when only recent strokes were examined. The low hospitalization rate may reflect a lack of information on patients who died during the interval or on those who did not associate their hospitalizations with their strokes.

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